The American Fertilizer

94 JANUARY 18, 1941 No. 2

91 YEARS OF SERVICE

H · J · BAKER & BRO.

271 Madison Ave., NEW YORK

BALTIMORE CHICAGO SAVANNAH TAMPA

Sole Distributors of

DRIED ACTIVATED SLUDGE

SANITARY DISTRICT of CHICAGO

IMPORTERS *EXPORTERS*

POTASH SALTS,

SULPHATE of AMMONIA, NITRATE of SODA, PERUVIAN BIRD GUANO, FISH MEAL, BONE MEAL, TANKAGE, BLOOD, NITROGENOUS,

AND ALL OTHER

FERTILIZER MATERIALS

INTERNATIONAL AGRICULTURAL CORPORATION

MANUFACTURERS OF HIGH GRADE FERTILIZERS

DEALERS IN

FERTILIZER MATERIALS

SUPERPHOSPHATE — MULTIPLE SUPERPHOSPHATE

— OMEGA TANKAGE —

— AMERICAN and FOREIGN POTASH SALTS —

— MINERAL AMMONIATES — TRISODIUM PHOSPHATE —

— COMPLETE FERTILIZERS —

FLORIDA PEBBLE ROCK PHOSPHATE—68%, 70%, 72%, 75%, 77%,
TENNESSEE PHOSPHATE ROCK—72%, 75%, 77%,

Let us quote on your requirements

General Office:
61 BROADWAY
NEW YORK CITY

Southern Headquarters:
ATLANTA, GA.

TRADE MARK

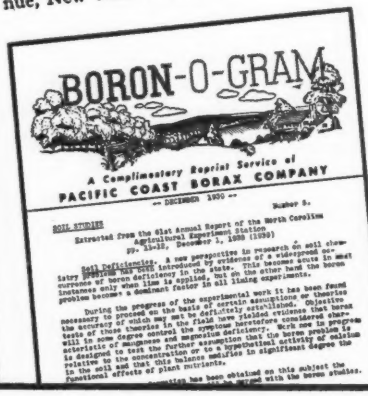
CROP PRODUCING
FERTILIZERS

Phosphate Rock Mines at
MULBERRY, FLA.
MT. PLEASANT, TENN.
WALES, TENN.

Satisfaction at Harvest Time

A Service to Agriculture

Continuing our policy of service to agriculture, we offer to you the Boron-O-Gram, a monthly reprint of scientific Boron literature. May we add your name to our mailing list? Please address: Pacific Coast Borax Company, 51 Madison Avenue, New York City, N. Y.



When Boron is Required

● Supply it with the well-known Twenty Mule Team Borax or Boric Acid. The Twenty Mule Team trade-mark, which has been a standard of quality for 50 years, guarantees these products as being 99½-100% pure.

BORAX and BORIC ACID

PACIFIC COAST BORAX COMPANY, 51 MADISON AVE.,
NEW YORK CITY • LOS ANGELES, CAL., 510 WEST 6TH ST.

Published every other Saturday. Annual subscription: In the United States, $3.00; Canada and Mexico, $4.00; other countries, $5.00. Entered as second-class matter, January 15, 1910, at the Post Office at Philadelphia, Pa., under Act of March 3, 1879. Registered in United States Patent Office. Publication office, 1330 Vine St., Phila., Pa.

A Complete Service

THE strategic factory locations of the American Agricultural Chemical Company, as shown on the accompanying map, assure prompt, dependable service for the complete line of products listed below.

We manufacture all grades of Commercial Fertilizers, Superphosphate, Agrinite Tankage, Bone Black, Bone Black Pigments (Cosmic Black), Dicalcium Phosphate, Monocalcium Phosphate, Gelatin, Glue, Ground Limestone, Crushed Stone, Agricultural Insecticides (including Pyrox, Arsenate of Lead, Calcium Arsenate, etc.), Trisodium and Disodium Phosphate, Phosphorus, Phosphoric Acid, Sulphuric Acid, Salt Cake; and we are importers and/or dealers in Nitrate of Soda, Cyanamid, Potash Salts, Sulphate of Ammonia, Raw Bone Meal, Steamed Bone Meal, Sheep and Goat Manure, Fish, Blood and Tin-Tetrachloride. We mine and sell all grades of Florida Pebble Phosphate Rock.

FACTORIES

Alexandria, Va.
Baltimore, Md.
Buffalo, N. Y.
Carteret, N. J.
Cayce, S. C.
Chambly Canton, Quebec, Can.
Charleston, S. C.
Cincinnati, Ohio
Cleveland, Ohio
Detroit, Mich.
East Point, Ga.
East St. Louis, Ill.
Greensboro, N. C.
Henderson, N. C.
Montgomery, Ala.
Norfolk, Va.
No. Weymouth, Mass.
Pensacola, Fla.
Pierce, Fla.
Port Hope, Ont., Can.
Presque Isle, Me.
Savannah, Ga.
Searsport, Maine
South Amboy, N. J.
Spartanburg, S. C.
West Haven, Conn.
Wilmington, N. C.
Havana, Cuba

The AMERICAN AGRICULTURAL CHEMICAL Co.

50 Church Street, New York City

SALES OFFICES

Alexandria, Va.
Baltimore, Md.
Buffalo, N. Y.
Carteret, N. J.
Charleston, S. C.
Cincinnati, Ohio
Cleveland, Ohio
Columbia, S. C.
Detroit, Mich.
East Point, Ga.
East St. Louis, Ill.
Greensboro, N. C.
Henderson, N. C.
Houlton, Me.
Laurel, Miss.
Montgomery, Ala.
Montreal, Quebec, Can.
New York, N. Y.
Norfolk, Va.
No. Weymouth, Mass.
Pensacola, Fla.
Pierce, Fla.
Port Hope, Ont.
Savannah, Ga.
Spartanburg, S. C.
St. Paul, Minnesota
Wilmington, N. C.
Havana, Cuba

PM
Since 1905

FLORIDA PEBBLE PHOSPHATE ROCK— Grades 77% B. P. L. and all standards to 68%. Also of special specifications—quality—calcining—grinding.

ELECTROPHOS* — A superior quality of triple superphosphate of approximately 48% available P_2O_5. Almost white in appearance.

FLORAPHOS* SUPERFINE — A standard quality phosphate rock ground to 85% minus 200 mesh 65% minus 325 mesh. Used extensively as a soil conditioner. Total P_2O_5 31%.

FLORAPHOS* FINE — Standard quality phosphate rock. Total P_2O_5 31%. Ground to a fineness of 90% minus 100 mesh 60% minus 200 mesh.

FLORAPHOS* FILLER — A phosphatic product of approximately 55% B. P. L. running 65% minus 100 mesh. Used in place of inert fillers in fertilizer mixtures.

*Trade Mark

Electric Furnace Products

Phosphorus—Phosphoric Acid 75% Pure Food Grade

THE PHOSPHATE MINING COMPANY
110 WILLIAM STREET, NEW YORK

"TRONA"
POTASH

Trona Muriate of Potash is now being used from coast to coast. Uniformity—excellent mixing qualities—prompt deliveries—have contributed to the increasing popularity of this American product.

Manufacturers of Three Elephant Borax and Boric Acid
See Page 23

Branch Offices: 214 Walton Building ATLANTA, GEORGIA; 542 Conway Building CHICAGO, ILLINOIS; 609 South Grand Avenue LOS ANGELES, CALIF.

AMERICAN POTASH & CHEMICAL CORPORATION
70 Pine Street New York City

TRONA

...THE...

AMERICAN FERTILIZER

"That man is a benefactor to his race who makes two blades of grass to grow where but one grew before."

Vol. 94 JANUARY 18, 1941 No. 2

Pasture Fertilization and Management*

By H. R. SMALLEY

Head of Soil Improvement Work, National Fertilizer Association, Washington, D. C.

IT is an honor to be invited to address this ancient and honorable Society which has done so much to improve the agriculture of this region. I am especially glad to have an opportunity to speak on pasture fertilization and management for this is a subject in which I have been intensely interested for more than a decade. I feel very humble when I remember that at least some members of this Society were interested in this subject over 100 years ago.

One of your honorary members, Mr. E. S. Bayard, editor of the Pennsylvania Farmer, in an editorial in that journal written in 1936, refers to the work of William West of Delaware County, Pennsylvania, who was born in 1724 and died in 1808. From this editorial I learned that Mr. West was a pioneer in the improvement of pastures in this country. I quote from Mr. Bayard:

About 1765 he grew clover, then a comparatively new crop in Pennsylvania. It gave him much hay, but clover fields must be renewed, and that meant the plowing of upland fields adapted best to permanent pastures. So William West studied permanent pastures and their development on lands then notable mainly for their crop of wild blackberries. He used gypsum, *lime and manure to make those lands produce 'the permanent native green grass'* or as we know it bluegrass. In a few years the had the pleasure of grazing 40 cattle on an area that would hardly support 10 cattle when he began his work on pastures. So far as we know William West was the first man in America to make a special study of permanent pasture and to demonstrate its value. Is there any record of any earlier study of this problem in America or an earlier demonstration?"

It is also interesting to learn that as early as 1797 an Englishman, Dr. John Anderson, in his "Essays Relating to Agriculture and Rural Affairs" outlined in considerable detail the system of rotational grazing which we learned about in this country after the World War and which had been developed during the war in Germany as the so-called Hohenheim plan of pasture improvement. I shall quote a few sentences from Doctor Anderson which relate to the rotation of pastures:

"To obtain this constant supply of fresh grass, let us suppose that a farmer, who has a large extent of pasture-ground, should have it divided into fifteen or twenty divisions, nearly of equal value; and that instead of allowing his beasts to roam indiscriminately through the whole at once, he should collect the whole number that he intends to feed, into one flock, and turn them all at once, into one of these divisions. In this case, the grass being quite fresh, and of a sufficient length for a full bite, it would please their palate so much as to induce them to eat it greedily, and fill their bellies before they thought of roaming about, and thus destroying it with their feet. And if the number of beasts were so great as to consume the best part of the grass of one of these inclosures in one day, they might be allowed to remain there no longer; giving them a fresh inclosure every morning, so that the same delicious repast might be again repeated. And if there were just so many inclosures, as there required days to make the grass of these fields advance to a proper length after being eaten bare down, the first field would be ready to receive them, by the time they had gone

* Address given at a meeting of the Philadelphia Society for Promoting Agriculture, January 17, 1941.

over all the others; so that they might be thus carried round in constant rotation."[1]

Many years passed, however, before anything was done to improve pasture soil. It is true that the grass experiments at Rothamsted were started about 100 years ago and showed that pasture yields could be increased by use of fertilizer, but it was a long time before these results were translated into farm practice even in England.

Early English Pasture Tests

It is my impression that the first large-scale improvement of pasture in England occurred in Northumberland County where the use of lime and basic phosphate slag became quite general about 50 years ago. This development was due, in part at least, to the work of Dr. William Somerville, Director of the Cockle Park Experiment Station near New Castle. I visited the Cockle Park Epxeriment Station three years ago last summer and met there a Mr. Langdale, a local fertilizer manufacturer. Later he sent me a reprint of an address given by his father on January 4, 1893, in which the improvement of pastures by the use of phosphate, lime, and potash was discussed at considerable length. I was especially struck by the fact that, even as early as that, the use of nitrogen to get early grazing was being talked about. I shall quote one sentence from Mr. Langdale:

"But even on pasture land an intelligent dressing of nitrogenous manure will prove profitable, when time is money, and you may for certain purposes find it pays to feed the grasses with nitrogen on pasture—for instance, to get an early bite of grass for ewes, lambs, and land that has just been got to grow clovers abundantly and on which you also want grasses to come quickly."

It was interesting to me to learn that the improved pastures in Northumberland are often referred to as "fattening pastures"—the common practice being to import Irish steers and fatten them for market on pasture supplemented by a minimum quantity of feed, particularly of cottonseed meal.

In this country the effect of fertilizers in stimulating the growth of grasses and clover has, of course, been known for a long time, but I feel fairly safe in stating that the first pasture experiment to be conducted which involved the actual grazing of fertilized plots was begun at Storrs, Connecticut, in 1921. In 1927 a very comprehensive Hohenheim Experiment was begun at the Massachusetts Experiment Station, and these experiments showed the great possibilities of pasture improvement and management.

In 1928, a few simple tests were conducted by The National Fertilizer Association in New England. The results obtained were so promising that in 1929 over 100 tests were conducted in the Northeastern States, several of them being located in Pennsylvania. I cannot go into any detail in describing these experiments, but I do want to give merely the highlights. Superphosphate alone increased the yield of pasture herbage 38 per cent. Superphosphate and lime increased the yield 48 per cent. Superphosphate, potash, and lime increased the yield 76 per cent, and a complete fertilizer and lime increased the yield 128 per cent. Both the phosphate and potash were needed in most cases to bring in the clover and the animals which were allowed to graze certain portions of the plots almost invariably preferred the fertilized areas. In 1930 we conducted about 80 actual tests on dairy farms in the Northeastern States. In each case the farmer was advised to fertilize a few acres of pasture and to keep records both on the fertilized and unfertilized areas. Our figures at the end of the season indicated that there had been an average net return of $32.00 per acre for the liming and fertilizer treatment. Stated in another way, there was a net return of $3.25 per dollar invested. Feed costs were greatly reduced, the days of grazing per acre were doubled, and milk production per acre was doubled.

Pasture Experiments Increasing

During the past ten years, interest in pasture improvement has increased by leaps and bounds and several hundred pasture experiments have been started by State and Federal agencies. In fact, we made a survey five years ago and found that over 300 experiments were then in progress. The results of these experiments are constantly confirming conclusions which we reached ten years ago, namely, that the improvement of pastures is one of the most profitable things a farmer can do.

The kind of improvement—the amount of lime and the amount and kind of fertilizers—that can be made most profitably will depend to a very large extent on the kind and quality of livestock on the particular farm. I also want to emphasize the importance of pasture and hayland management, but as this is the subject of the picture which I am to show you, I

(Continued on page 18)

[1] I am indebted to Dr. D. B. Johnstone-Wallace of Cornell University for calling attention to Doctor Anderson's essays.

American Cyanamid Co. Installs Electron Microscope

AMERICA'S first commercially-built electron microscope, which enables scientists to picture minute objects at 100,000 times natural size, is now being operated in the Stamford Laboratories of the American Cyanamid Company, Stamford, Conn., according to an announcement made recently by the company. Although several experimental microscopes of the kind have been built and used, the first American commercial instrument is being used by American Cyanamid's scientists to develop new chemicals for industry and medicine. The instrument was developed and built by the RCA Research Laboratories in Camden, N. J.

Results already obtained by American Cyanamid research workers in the study of pigments used in the paper industry (precipitated chalk and magnesium oxide) show that infinitely fine particles of these materials possess the same crystalline structure in small as in large pieces. This disproves the theory widely held heretofore that such pigments lose their crystalline character when precipitated as infinitesimally fine particles.

Photographs made directly in the electron microscope show the object magnified 20 to 30 thousand times. However, details are so clearly pictured in these photographs that they can be readily enlarged to give a total useful magnification of 100,000 times natural size. An average human hair subjected to such huge magnification would appear to have a diameter a great as California's giant trees, and an object an inch long so magnified would appear to be more than one and one-half miles in length! The limit of magnification of the best optical microscopes is about 1,000 times natural size. Photographs made in preliminary tests of the instrument show what are presumed to be individual giant molecules, the shapes and sizes of colloidal particles, and intimate details of certain types of bacteria, which the weaker power of optical microscopes could not reveal. Individual giant molecules of polyvinyl chloride resin have been pictured with the aid of the electron microscope. Particles of colloidal carbon appear generally spherical in shape and on a diameter of about four ten-millionths of an inch. Photographs of anthrax baccilli, germs of pneumonia and typhoid bacteria show these to possess strangely intricate structures. These micro-organisms apparently are not the simple bits of jelly-like substance seen by customary light microscopes.

Applications of the new instrument in the American Cyanamid laboratories are expected to uncover new and important facts about the action of catalysts, which mysteriously promote chemical reactions; about the action of chemicals on the bacteria of disease, since it may be possible to see how the drug actually killed the germ; and about the nature of synthetic resins and the processes by which they are formed. Other fields in which the laboratory is actively engaged, and to which the new instrument will be applied include the flotation of ores and the recovery of metals by cyanidation; the manufacture of special chemicals used in the leather and paper industries; the treatment of textiles; rubber chemicals and their action in prolonging the useful life of rubber goods; synthetic resins, and plastics and enamels into which they enter; insecticides and fungicides, important to agriculture in the control of insects and diseases of plants; fertilizers and plant hormone substances; and a wide variety of chemical products, many of which are made from the company's basic raw material, calcium cyanamid.

Latest Scientific Apparatus

The electron microscope supplements an imposing array of special apparatus already employed in American Cyanamid's Stamford Laboratories in solving abstruse problems of producing and applying chemicals in industry. Ultraviolet and infra-red spectrographs, used to measure colors invisible to the human eye, form the nucleus of one of the most complete spectroscopic laboratories in American industry today. Microchemical methods of analysis, for determining the chemical composition of minute samples, and pilot plant production units to study manufacturing methods and provide quantities of new chemicals sufficient for tests in industry, are at the two ends of the scale of operations in the laboratory. Samples as small as a few grains can be completely analyzed in the microchemical laboratory and the

(Continued on page 24)

No Skyrocketing of Fertilizer Prices*

By T. E. Milliman

Farmers in this country occupy an improved position in two major respects over the situation that they found themselves in on fertilizers in the preceding World War. Then, too, we have a minor improvement, which I shall also mention.

The first big improvement in our situation has to do with nitrogen. In the first World War, this country found itself woefully short of nitrogen. At that time, the supply for our national needs was limited almost entirely to by-product sulphate of ammonia, nitrogen from coke ovens and gas producers on the one hand and Chilean nitrate on the other. This severe limitation caused such a stringent market situation that the prices of both Chilean nitrate of soda and sulphate of ammonia rose to more than $200 a ton.

More Nitrogen Available

At the present time, there is more sulphate of ammonia being produced in this country than at any time during the last World War. This is due primarily to our enlarged productive capacity on steel. The road to Chile by means of the Panama Canal remains open and unmolested, and Chilean nitrate imports are now up from any recent year. Reassuring as these two factors may be, they are not as important as the improved situation which has come to us from the development of synthetic nitrogen production in this country.

The second largest synthetic nitrogen fixation plant in the world is owned by the Allied Chemical and Dye Corporation at Hopewell, Virginia. The largest is in Germany. In the U. S. A. probably the second largest synthetic nitrogen fixation plant is owned by Du Pont at Belle, West Virginia. In both cases, the electric energy needed to fix nitrogen in these plants is supplied by the nearby West Virginia coal fields. The Hopewell Plant is on deep water, but the Belle, West Virginia plant is in the mountains. The third plant serving American agriculture is the American Cyanamid Company Plant located just outside this country in Niagara Falls, Ontario. No restrictions have as yet been placed upon shipment of cyanamid nitrogen from Canada to the U. S. A.

In addition to these three major plants now principally serving agriculture, the U. S. Government has authorized the establishment of two plants for the production of synthetic nitrogen for munitions. These two plants will be located in the Middle West, although one of them is to be on the border of the upper South.

Little Price Advance Expected

In the meantime, the productive capacity of the three plants referred to, when added to the nitrogen secured from by-product Sulphate of ammonia and Chilean nitrate, is sufficient for the needs of American preparedness and agriculture. The price to farmers on nitrogen used in mixed fertilizer, or used separately as such. will be up in spring of 1941 less than 5 per cent from spring of 1940. It is expected that the price to farmers on Chilean nitrate, sulphate of ammonia, and cyanamid will be not more than $1.00 up from the preceding year.

Also, in addition to the above nitrogen plants, I must tell you of the government's allocation of six and a half million dollars for the establishment at Muscle Shoals of facilities for the production of synthetic nitrogen there. Some of the old buildings erected in the first World War will be utilized. Power here, as in the case of the Cyanamid Plant at Niagara Falls, will come from hydro-electric energy.

We Are Producing Potash

The official price record on potash in the first World War was $483 a ton for 48 per cent muriate. Actually, sales were made for chemical purposes at higher figures. Except for a little potash from Spain, and still less from surface deposits in California and the Dakotas, this country was without potash after war was declared upon Germany. Today the production capacity of the three potash mines near Carlsbad, New Mexico, and the potash brine refinery at Searles Lake, California, is equal to American needs in the spring of 1941, when fortified with European potash, principally French, that was on hand here, or on water before the collapse of France. By spring, 1942, the production capacity of the American potash companies will equal American needs. The price of potash to American farmers in the spring of 1941 will be essentially the same as it was a year earlier. Any upward swing will be the result of increased costs on transportation, bags and handling. The price to fertilizer manufacturers remains the same.

The phosphorus or superphosphate situation is more favorable than it was in the first World War, and it was not unfavorable then. There was at that time plenty of productive capacity of the phosphate rock from Florida and Tennessee, and for acidulating the rock into superphosphate at northern ports. There then came,

(Continued on page 24)

*Reprinted from "American Agriculturist," December 7, 1940

Phosphorus in Human and Animal Health*

By TOM S. HAMILTON

Associate Professor of Animal Nutrition, University of Illinois, Urbana, Ill.

(Continued from the January 4 issue)

V. Phosphorus Deficiency in Animals

The continued feeding of a ration deficient in phosphorus, or any other essential food nutrient, will eventually lead to a train of characteristic pathological symptoms, ultimately death. But what is equally important, even before clinical symptoms of the deficiency appear, is the impairment in the productivity of the animal.

In any discussion of phosphorus deficiency it is impossible to omit all discussion of calcium, because bone growth and metabolism involve both elements to such a great extent and because the metabolism of one so often depends upon the metabolism of the other.

Since grains and seeds are relatively poor in calcium and at the same time comparatively rich in phosphorus, it might be predicted that swine and poultry-species that ordinarily live on such feeds and their byproducts—would be more liable to suffer from a calcium deficiency than from a phosphorus deficiency. On the other hand, hays, grasses, and forage crops are relatively rich in calcium and comparatively poor in phosphorus. Therefore it might be predicted that cattle, sheep, and horses—species for which these feeds constitute the bulk of the ration, if not the entire ration for certain groups of these animals—would be more likely to suffer from a phosphorus than from a calcium deficiency. In general these predictions are true.

In young animals the first effect of a phosphorus deficiency is rickets, a disease characterized by the failure of the bones to calcify. The result is enlarged joints, crooked or malformed bones. Rickets is a disease of young animals only and may be caused by any one of the following: (1) a phosphorus deficiency —the usual cause of rickets in the phosphorus-deficient areas throughout the world; (2) the absence of vitamin D or sunlight, even though there may be a sufficient amount of both calcium and phosphorus in the ration—infantile rickets is often caused by this condition; and (3) a disproportion of calcium and phosphorus in the ration—a very high calcium, low phosphorus, low vitamin D ration is commonly used in the nutrition laboratories to produce rickets in rats experimentally. Nevertheless, regardless of which of these conditions prevail, the direct cause of rickets seems to be an impairment in phosphorus assimilation and retention. Rickets may often be prevented, or even cured, by reducing the calcium in the ration. This is particularly effective if plenty of vitamin D is available.

There is another pathological condition of the bones in which the mineral content is reduced and which is often erroneously called rickets. This condition differs from rickets in that it occurs in adult animals as well as in young animals. It is caused by a calcium deficiency and is correctly referred to as osteoporosis. This condition may be prevented and cured by raising the calcium content of the ration—this being just the reverse of the cure for rickets. Also vitamin D or ultraviolet radiations are of little or no benefit in preventing or in curing osteoporosis.

In adult animals a phosphorus deficiency leads to a distinct and characteristic condition called aphosphorosis, although other names for the same condition are used in various parts of the world. In South Africa it is called "styfsiekte"; in Australia it is "cripples" or "peg-leg"; in Florida it is "sweeny" or "stiffs"; and in other places it is referred to simply as "bone-chewing" disease. No continent on the face of the globe is free from this disease.

Although this condition was reported as early as 1785, it was not definitely diagnosed as a phosphorous deficiency until 1924 by Theiler and associates of South Africa. Shortly after this, Eckles, Palmer and Becker of Minnesota arrived at the same explanation of the disease. The primary disease, as well as the secondary diseases developing from it, have been reported from South Africa, Germany, Austria, Sweden, Central America, Australia, New Zealand, Tasmania, Cyprus, Hawaii, and Guam. In this country, aphosphorosis has definitely been recognized in Montana, Minnesota, Wisconsin,

* A paper given before the Western Phosphate Conference, held at Ogden, Utah, September 5 and 6, 1940.

Michigan, Kansas, Utah, California, Texas, Oklahoma, New Mexico, and Alabama; and less certainly in New York, Pennsylvania, West Virginia, South Carolina, and Mississippi.

Aphosphorosis

Aphosphorosis, or bovine osteomalacia, is primarily a disease associated with phosphorus-deficient soils and consequently phosphorus-deficient forages. When animals subsist for long periods of time on forages which contain less than about 0.15 per cent phosphorus on the dry basis, aphosphorosis is a possibility, although there is usually no consistent and serious damage until the phosphorus content drops below 0.12 or 0.13 per cent. Many crops raised in the phosphorus-deficient areas contain less than 0.10 per cent phosphorus on the dry basis.

Only those animals which subsist for long periods of time on phosphorus-deficient forages are susceptible to aphosphorosis and also all species are not alike in their susceptibility to the disease. Cattle are the most susceptible while sheep are much less so, even when grazing on the same forage. Horses also are much less susceptible than are cattle, and aphosphorosis has been produced in swine by experimental procedures only. According to Marston, sheep grazing on phosphorus-deficient forage will usually show symptoms of protein deficiency before showing any apparent symptoms of phosphorus deficiency. As I mentioned before there is usually a close relationship between the phosphorus and protein contents of feeds, so when there is a shortage of one there is usually a shortage of the other also. In fact it seems to me that it is very doubtful that under practical conditions a phosphorus deficiency occurs without a simultaneous protein deficiency also. Horses bred and raised in the South African veldt are frequently undersized, although typical symptoms of aphosphorosis rarely occur.

To say that aphosphorosis has harassed the cattle industry in many parts of the world, is putting it mildly. It would be impossible to calculate the loss which this disease has caused and is causing.

The chain of events leading to this disease starts with a deficiency in the soil of *available* phosphorus. This gives rise to crops which are not only limited in quantity by the lack of essential plant food, but even more seriously limited in quality by their lack of phosphorus (and also protein). Cattle in particular on this type of forage develop a craving for phosphorus-rich materials such as bones. It is for this reason that the disease is often referred to as the bone-chewing disease. Cattle with aphosphorosis will also chew wood and other solid objects. This craving for bones is properly called osteophagia. Pica, a term often used in this connection, means only a depraved appetite.

The consumption of bones and carcass debris by cattle on the range often leads to a quick and violent death due to botulism. During putrefaction of animal matter in the open, it frequently becomes infected with a widely distributed organism, Clostridium Botulinum, which produces a powerful poison. Animals, particularly domestic animals, consuming this infected material die very quickly. Bovine botulism is called "lamsiekte" in South Africa and it is probably identical with the so-called "loin-disease" of Texas. The reason why more animals do not die from botulism is because most of our domestic farm animals normally shun putrefied matter. It is only in those cases where the animals are starved for phosphorus that they resort to it.

The symptoms of uncomplicated aphosphorosis in cattle are, first, a loss of appetite, particularly for the phosphorus-deficient forage and, of course if this is the only feed available, retardation, if not cessation, of growth. Then the craving for phosphorus-rich foods leads to the chewing of bones, pieces of wood, and other solid material. The inorganic phosphorus in the blood decreases and the bones become fragile. Lameness and stiffness result. What is even more important is the deleterious effects of aphosphorosis upon reproduction.

Aphosphorosis impairs fertility, decreases milk production, and lowers the resistance to infections. Cows with aphosphorosis have irregular estrus cycles and often fail to come in heat for long periods of time. Whether or not aphosphorosis is the primary cause of this has not been definitely proved, but under practical conditions irregular estrus is almost always a characteristic symptom.

Theiler says that in South Africa cows in the phosphorus-deficient areas regularly give birth to calves but once in two years, and gives as the explanation that after the drain on the cow's body during the growth of the fetus and the further and more drastic drain on her phosphorus reserves during lactation, it requires a year or more to again store sufficient phosphorus to enable her to go thru another pregnancy and lactation. Similar subnormal calf production in the phosphorus-deficient areas in the United States has been attributed also to aphosphorosis. This disease, however, is not directly concerned with abortion.

A marked decrease in milk production can be produced readily in animals maintained on

a phosphorus-deficient ration and this has also been a common observation in the cows in the phosphorus-deficient areas.

The remedies for aphosphorosis are suggested by the train of events leading to its occurrence. The immediate remedy is the administration of phosphorus supplements. These may be either in the form of mineral phosphates, phosphorus-rich feeds such as the oil meals, or even forages grown on phosphorus-rich soils. The feeding of bone meal is efficacious if the animals can be made to consume 3 or 4 oz. per head daily. Dicalcium phosphate is an excellent source of phosphorus although it is not as palatable as bone meal. Sodium or potassium phosphates, precipitated calcium phosphate, and phosphoric acid have all been used with success. The addition of a soluble phosphate to the drinking water has been found to be an effective and satisfactory remedy also. Raw rock phosphate is not recommended as a phosphorus supplement in animal feeding because of the toxic nature of the fluorine present. Raw rock phosphate containing less than two percent fluorine (this is much less than is usually found in the natural deposits in the United States) has been fed to animals and found to be definitely toxic. Pure calcium phosphate to which has been added as little as 0.5 per cent fluorine has also been found to be harmful. Only when the fluorine has been removed almost completely from the rock by roasting or bv some other approved procedure is it suitable for feeding livestock.

The permanent remedy for aphosphorosis is the building up and the continued maintenance of sufficient available phosphorus in the soil so that the crops grown will contain a normal content of phosphorus. Remarkably and highly satisfactory results have been common following the application of phosphate fertilizers to soils deficient only in phosphorus. Not only have the yields of potatoes, beets, alfalfa, and other crops been enormously increased, but the concentration of phosphorus and protein have been increased several hunderd precent, the latter being particularly true in case of the grasses and grass hays.

In areas where range is cheap, or where rainfall or irrigation water is scarce, or on certain types of soil, the immediate remedy is the only practical one.

VI. Phosphorus Requirements and Some Practical Considerations

In considering the phosphorus requirement of animals, a few general principles may be of value. The phosphorus requirement of a young animal is definitely related to the rate of growth. From this we can say that in general the more rapid the growth rate the higher should be the percentage of phosphorus in the ration. Also the percentage of phosphorus should be higher in the ration of a rapidly growing animal than of a slowly growing one. It is, of course, obvious that the total amount of phosphorus needed by an animal is equal to that needed for maintenance plus the amount of phosphorus in the product produced—due allowance being made for the wastage in digestion and metabolism.

In the following discussion 50 per cent will be allowed for the wastages and all percentages will be on the dry weight of the ration.

Poultry. The percentage of phosphorus required by poultry during the first few weeks is about 0.45 per cent. This percentage decreases rapidly during growth so that at maturity the actual amount required may be no more than about 0.16 per cent.

For adult non-laying hens, in order to maintain a good reserve of phosphorus, a percentage amounting to about 0.25 is probably sufficient. The phosphorus requirement for egg production is not nearly so intense as is the calcium requirement. Starting with 0.25 per cent as adequate for the non-laying hen, 0.30 per cent would be required by a hen laying an egg every four days; 0.32 per cent for one laying an egg every other day; and 0.38 per cent for a hen laying an egg a day. This increase is small compared with that of calcium, which increases from about 0.4 for the non-laying hen to nearly 4.5 per cent for the hen laying an egg a day.

In case of poultry, the phosphorus requirement can almost always be satisfied by a judicious selection of concentrated feeds, seed byproducts, and animal supplements ordinarily used in balancing rations for poultry. In fact, some care should be exercised that an excess of phosphorus is not present, particularly in rations of the growing chick, since excess phosphorus seems to make the conditions conducive to perosis or slipped tendon more critical.

Swine. Swine have a phosphorus requirement at weaning which is satisfied by a ration containing about 0.4 per cent phosphorus. This percentage decreases rather rapidly so that at maturity a ration containing about 0.18 per cent phosphorus is probably adequate.

Since the swine ration, like the poultry ration, is commonly made up quite largely of grains, seed byproducts, and animal supplements containing either bone or milk, there should be

(Continued on page 20)

THE AMERICAN FERTILIZER
ESTABLISHED 1894

PUBLISHED EVERY OTHER SATURDAY BY WARE BROS. COMPANY
1330 VINE STREET, PHILADELPHIA, PA.

A MAGAZINE INTERNATIONAL IN SCOPE AND CIRCULATION DEVOTED EXCLUSIVELY TO THE COMMERCIAL FERTILIZER INDUSTRY AND ITS ALLIED INDUSTRIES

PIONEER JOURNAL OF THE FERTILIZER INDUSTRY

WARE BROS. COMPANY
PUBLISHERS

1330 VINE STREET PHILADELPHIA, PA.

A. A. WARE, EDITOR

ANNUAL SUBSCRIPTION RATES

U. S. and its possessions, also Cuba and Panama.....$3.00
Canada and Mexico..... 4.00
Other Foreign Countries 5.00
Single Copy..... .25
Back Numbers..... .50

THE AMERICAN FERTILIZER is not necessarily in accord with opinions expressed in contributed articles that appear in its columns. Copyright, 1941, by Ware Bros. Company.

Vol. 94 JANUARY 18, 1941 No. 2

Principal Articles in This Issue

PAGE

PASTURE FERTILIZATION AND MANAGEMENT 5

AMERICAN CYANAMID CO. INSTALLS ELECTRON MICROSCOPE 7

No Skyrocketing of Fertilizer Prices..... 8

PHOSPHORUS IN HUMAN AND ANIMAL HEALTH 9

U. S. Government to Buy Chilean Nitrate Supply 12

OBITUARY:

Walter W. McIntyre 13

Fairley L. Bowen 13

Carleton Ellis 13

FERTILIZER MATERIALS MARKET:

New York 15

Baltimore 17

Chicago 17

Wilmington 18

U. S. Government to Buy Chilean Nitrate Supply

The Defense Supplies Corporation, a Reconstruction Finance Corporation subsidiary, has announced a contract to purchase 300,000 short tons of nitrate of soda in Chile to be held as a part of the military reserve stock pile of strategic materials.

This purchase has been under discussion in government circles for several months, and according to the best information available the chief reason for the purchase is to improve Chile's dollar exchange position. The Metals Reserve Company, another R.F.C. subsidiary, is engaged in acquiring 100,000 tons of South American copper, about 85 per cent of which comes from Chile, but in spite of this it is understood that Chile is having difficulty getting exchange to purchase needed commodities in the United States.

The administration's program for improving commercial and cultural relations between the American Republics includes such government actions to make it possible for Latin-American countries to buy more in this country. Nitrate of soda is listed by the Army and Navy Munitions Board as a strategic material because it can be used in the manufacture of explosives and is also an essential fertilizer. Modern methods of manufacturing military explosives usually employ other forms of nitrogen, and this country now has facilities for synthesizing large quantities of both nitrate of soda and other forms of nitrogen, but officials felt that this purchase of Chile nitrate would constitute a prudent military reserve as well as aiding a sister Republic.

The purchase price, as announced by Jesse H. Jones, Federal Loan Administrator, will be on the basis of $18 per short ton, bulk, f.a.s Chilean ports, delivery to be made prior to June 30, 1941.

The contract calls for shipping 100,000 tons directly to the United States for storage, and the balance of 200,000 tons will be stored temporarily in Chile. The contract was made with the Chilean Nitrate & Iodine Sales Corporation and requires that agency to pay to the Chilean government or to the Central Bank of Chile, against Chilean pesos, in United States currency, the sum of $10 per ton of the purchase price received for the nitrates.

This dollar exchange for the government of Chile, Mr. Jones stated, is in addition to the 25 per cent of the seller's profit, if any, in the sale of nitrates, as required by Law 5350 of the Republic of Chile.

POTASH EXPORTS TO BE LICENSED

Effective February 3rd, exports of potash can be made only under license issued by the State Department at Washington. This provision was contained in a proclamation issued on January 10th by President Roosevelt which placed under license control all exports of potash, copper, brass, bronze, zinc and nickel. Under supplementary regulations issued subsequently, all potash fertilizer salts such as muriate, sulphate and nitrate, as well as any other potassic fertilizer material containing 27 per cent or more of K_2O, are included in the provisions of the proclamation.

ALABAMA CONSERVATION PLAN

Alabama farmers will try an experimental AAA program next crop year. Known as the Alabama plan, because this State is the first to adopt it under the provisions of the AAA program for 1941, it became operative December 1, 1940. Most important provisions provide that the payments for planting within special crop allotments, such as cotton, are conditioned upon the farmers' carrying out conservation plans that will improve and conserve the fertility of the soil. Among the minimum requirements are: growing each year an acreage of approved erosion-resisting and soil-conserving crops equal to 25 per cent of the total crop land of the farm. Each farmer shall maintain or establish during the next five years at least one acre of pasture for each fifteen acres of crop land.

GEORGIA CROPS SHOW INCREASED VALUE IN 1940

An increase in value of $20,000,000 in crops produced by Georgia farmers in 1940 over 1939 is reported by Archie Langley, Agricultural Statistician of Georgia Crop Reporting Service. This value is 14 per cent greater than the 1939 figure. The 1940 total value was $163,822,000 as compared with $143,896,000 in the previous year. Increase was due to higher yields per acre and higher prices for certain crops, rather than to increase in acreage, with peanuts having the greatest increased value with 57.3 per cent. Current yield of 251 pounds of cotton was highest in the history of Georgia, with the exception of three years—1911, 1914, and 1937. The 1940 cotton acreage of 1,926,000 was the lowest since 1873 with the exception of 1929, which was 1,920,000 acres.

Obituary

WALTER W. McINTYRE

Walter W. McIntyre, assistant sales manager of the Sales Agency Division of the Barrett Company, died at his home in New York on January 14th. Mr. McIntyre, who was 56 years of age, had been associated with the Barrett Company for more than 30 years. He had a wide circle of friends in the fertilizer industry.

FAIRLEY L. BOWEN

Fairley L. Bowen, of the Elmore Gin & Fertilizer Company, Laurinburg, N. C., died at his home on January 3rd after an illness of nearly three years. He had been superintendent of the Company's plant at Elmore for the past 25 years and had previously served as superintendent of other cottonseed oil mills and gins. Born in South Carolina, he moved to Scotland County, North Carolina, as a young man. He is survived by his widow, one son, Fairley L. Bowen, Jr., and two daughters, Mrs. Violet B. Caddell and Miss Sadie M. Bowen.

CARLETON ELLIS

Carleton Ellis, internationally known chemist and holder of more than 700 patents in the chemical field, died on January 13th at Miami, Fla., aged 64 years. He was co-author of a work on fertilizers "Soilless Growth of Plants."

"NITROGEN ABUNDANCE," NEW BARRETT BOOKLET

The Barrett Company has recently published a new 20-page booklet entitled "Nitrogen Abundance," which describes in non-technical language the function of nitrogen in the growth of the principal crops produced in the northeastern area of the United States. It points out that the art of growing big crops depends in large part on the skill with which nitrogen from legumes and other cover crops and nitrogen from animal manures is supplemented by nitrogen in commercial fertilizers and nitrogen fertilizer materials. While emphasis is placed on the Barret products, sulphate of ammonia and Arcadian nitrate of soda, the whole presentation is broad-guaged in concept and treatment.

An interesting feature is the discussion of the effect of cold weather and drought on the

availability of legumes and manures and the necessity for a careful watch for nitrogen-deficiency symptoms, with immediate applications of chemical nitrogen to remedy the deficiency.

The use of low-nitrogen, medium-nitrogen and high-nitrogen fertilizers on such crops as tomatoes, cabbage, spinach, corn, orchards and pastures is given adequate treatment.

The book is being distributed through interested fertilizer manufacturers and is available to teachers and others in reasonable quantities without charge. Copies may be obtained by writing to the Barrett Company.

THE PHOSPHATE MINING COMPANY ANNOUNCES CHEMICAL EXPANSION

As a part of its expansion program The Phosphate Mining Company announces the expected completion early in 1941 of two additions to its plants at Nichols, Florida, the products of which will supplement the production of the company's present chemical operations. One plant will produce sulphuric acid made by the contact process, and the other will produce phosphoric acid utilizing sulphuric acid from the new plant and phosphate rock from the company's own mines. This phosphoric acid will be used for triple superphosphate and other fertilizer phosphate chemicals. The concentrated superphosphate, which will be a product of these new plants, will be marketed as "PM" triple.

For some time The Phosphate Mining Company has been engaged in electric furnace operations producing elemental yellow phosphorus. From this is made food grade phosphoric acid of the highest quality and also a special product of concentrated superphosphate which is marketed under the trade marked name "Electrophos." The chemical products from the company's electric furnace operation are being sold in increasing quantities in the chemical field where extremely high qualities are demanded. This is the only electric furnace in Florida for the production of phosphorus.

The Phosphate Mining Company has been mining Florida pebble phosphate since 1905 and is well known to the buyers of phosphate rock in this and foreign countries. It operates its own power plant which supplies power for its chemical furnace operations, its mining and flotation plants, and supplementary operations of drying, grinding and calcining.

NITROGEN STATISTICS BY SYNTHETIC NITROGEN PRODUCTS COMPANY

The Statistical Department of Synthetic Nitrogen Products Corporation has issued its annual Report on Supplies and Disposition of Nitrogenous Fertilizer Materials for the Fertilizer Year 1939-1940. From various statistical sources and from their own investigations, figures have been compiled covering such subjects as total fertilizer materials used, amounts used in mixed fertilizers and those applied direct, domestic production and imports, consumption of nitrogen by non-agricultural industries.

The estimates for the principal nitrogen materials show 513,000 tons of sulphate of ammonia, 748,000 tons of nitrate of soda,, 120.000 tons of ammonia and other nitrogen solutions, 138,000 tons of cyanamid, 88,000 tons of calcium nitrate and related compounds, 67,000 tons of ammonium phosphates, 46,000 tons of potassium nitrate, 135,000 tons of cottonseed meal, 660,000 tons of other organics.

Copies of the report can be obtained by fertilizer manufacturers from the offices of the Synthetic Nitrogen Products Corporation, 285 Madison Ave., New York, so long as the supply lasts.

BRADLEY & BAKER

FERTILIZER MATERIALS - FEEDSTUFFS

AGENTS - IMPORTERS - BROKERS

155 E. 44th Street
NEW YORK

BRANCHES

Clinton St. & Danville Ave. Baltimore, Md.
505 Royster Building Norfolk, Va.
1252 West Beaver Street Jacksonville, Fla.

FERTILIZER MATERIALS MARKET

NEW YORK

Materials Market Shows Greatly Increased Activity. Organics Demand Stronger with Increases in Prices of Dried Blood and Tankage. Chemical Materials Remain Firm.

Exclusive Correspondence to "The American Fertilizer."

NEW YORK, January 17, 1941.

The market for raw fertilizer materials has shown considerably increased activity during the past week or so. Demand for spot materials has picked up as call came from fertilizer manufacturers in all sections of the country. Activity was particularly pronounced in the various organics and advances were made on dried blood and tankage.

Chemical fertilizers remain very firm at previously reported prices and an increasing volume of these materials is moving against seasonal contracts. Sulphate of ammonia continues to be very scarce and there is new and increased call for this material in the export field.

Nitrate of Soda

$29.40 per ton in 100-lb. bags, $28.70 in 200-lb. bags, and $27.00 in bulk, all f.o.b. port warehouse. Supplies continue to be ample and movement of material is strictly against contract.

Sulphate of Ammonia

Market remains very strong at schedule price; which, however, does not mean anything, since supplies are very scarce and no new domestic sales have been reported. Exporters are holding at around $42.00 per ton, f.a.s.

Superphosphate

This material is in fair demand with no change in price over previous levels. Triple superphosphate continues to be tight.

Potash

Schedule prevails with ordinary seasonal discount, and activity is confined to shipments against contract. Supplies of this material continue to be adequate for domestic demand.

Dried Blood

Advanced 10 cents per unit and last reported business was done at $2.50 ($3.04 per unit N), f.o.b. New York. This market is very firm and sellers are holding local material from $2.60 to $2.75 ($3.16 to $3.34½ per unit N), f.o.b. South American blood is very quiet due to the lack of shipping space.

Tankage

This market shows an increase in price with last sales of local production 9/10 per cent unground grade confirmed at $2.60 ($3.16 per unit N) and 10 cents, f.o.b. New York. Producers have very firm ideas and some are holding at $2.75 ($3.34½ per unit N) and 10 cents, f.o.b. South American supplies are being held at around $2.45 ($2.98 per Unit N), c.i.f, but difficulties in obtaining freight space retard any actual business.

Nitrogenous Material

This market shows a somewhat firmer tone but no change in previous price is to be noted yet. No new sales have been reported in the New York area recently.

Bone Meal

Demand for fertilizer bone meal was considerably better during the period under review and the general market is much firmer. South American raw bone 4½ and 45 per cent grade is quoted at $32.00 per ton c.i.f, but here again, buyers encounter freight difficulties.

Fish Scrap

Menhaden scrap is purely nominal since there are no offerings available. Japanese fish meals continue to be unquoted on this market.

The Solvay Process Company, a subsidiary of the Allied Chemical & Dye Corp., will operate the Government-owned ammonia plant to be erected at West Henderson, Ky., at an estimated cost of about $11,000,000. The project has been cleared by the National Defense Advisory Commission and approved by the President.

FERTILIZER MATERIALS

LET US QUOTE YOU ON YOUR REQUIREMENTS OF THESE MATERIALS

PHOSPHATE ROCK
SUPERPHOSPHATE
DOUBLE SUPERPHOSPHATE
NITRATE *of* SODA
SULPHURIC ACID
SULPHATE *of* AMMONIA
BONE MEALS
POTASH SALTS
DRIED BLOOD
TANKAGES
COTTONSEED MEAL
BONE BLACK
PIGMENT BLACK
SODIUM FLUOSILICATE

ARMOUR FERTILIZER WORKS

General Offices: Walton Building, Atlanta, Ga.

Division Sales Offices:

Albany, Ga.
Atlanta, Ga.
Augusta, Ga.
Baltimore, Md.
Birmingham, Ala.
Chicago Heights, Ill.
Cincinnati, Ohio
Columbia, S. C.
Columbus, Ga.
East St. Louis, Ill.
Greensboro, N. C.
Havana, Cuba
Houston, Texas
Jacksonville, Fla.
Montgomery, Ala.
Nashville, Tenn.
New Orleans, La.
New York, N. Y.
Norfolk, Va.
Presque Isle, Me.
San Juan, P. R.
Sandusky, Ohio
Wilmington, N. C.

BALTIMORE

Market Quiet Before Spring Shipping Season Starts. Manufacturers Well Covered on Materials Requirements.

Exclusive Correspondence to "The American Fertilizer."

BALTIMORE, January 15, 1941.

The market on fertilizer materials in this section remains practically unchanged in view of the fact that mixed goods for the spring season will not start moving out until March, and in the meantime, all the manufacturers have their warehouse filled to capacity in preparation for the spring shipping season.

Ammoniates.—The demand for tankage for fertilizer is practically nil, and the market for feeding purposes ranges from $2.90 to $3.00 per unit of nitrogen, while South American ground dried blood is quoted subject to freight room being obtainable, around $2.90 per unit of nitrogen, c.i.f. Atlantic ports.

Nitrogenous Material.—While there is a firmer tone in the market, this only applies to those manufacturers who are able to ship into the southern territory, and price here remains unchanged at $2.55 to $2.65 per unit of nitrogen, f.o.b. Baltimore.

Sulphate of Ammonia.—Manufacturers are still taking deliveries against contracts previously booked, and there have been practically no re-sales for domestic use. The export market continues firm, and ranges from $41.50 to $45.00 per ton, in double bags, f.a.s. Baltimore.

Nitrate of Soda.—There has been a slight improvement in the demand, and the Chilean Champion Brand is still being quoted at $29.40 per ton of 2,000 lb., in 100-lb. bags ex port warehouse, while price in 200-lb. bags is $28.70 and in bulk, $27.00.

Fish Meal.—This material continues in short supply and re-sale lots of Japanese sardine meal continue to be quoted at $59.00 to $60.00 per ton, f.o.b. Baltimore.

Superphosphate.—The market is unchanged at $8.00 per ton of 2,000 lb. for run-of-pile, basis 16 per cent, and $8.00 for flat 16 per cent grade, both in bulk, f.o.b. producers' works Baltimore, and no immediate change in prospect.

Bone Meal.—The demand for bone products during the past few months has been lighter than usual, and is doubtless due to the comparatively high prices prevailing in comparison with other fertilizer materials. The price of 3 and 50 per cent steamed bone meal ranges from $32.00 to $34.00 per ton, f.o.b. Baltimore, while South American 4½ and 47 per cent raw bone meal is quoted at $31.00 to $32.00 per ton, c.i.f. Baltimore.

Potash.—It would appear that fertilizer manufacturers will be able to secure their normal requirements for the spring season, and in consequence of this there have been practically no resales, which are quoted at 55 cents per unit for muriate in bulk.

Bags.—The market on burlap is practically unchanged, and plain, new, 10-oz. bags, basis 40, cut 54 in., range around $118.00 per thousand, f.o.b. Baltimore for spring delivery.

CHICAGO

Fertilizer Organics Market Quiet with Prices Steady. Feed Market Rising. Bone Meals Scarce.

Exclusive Correspondence to "The American Fertilizer."

CHICAGO, January 13, 1941.

Continuance of the slow market in organic is all too apparent. Inquiry remains extremely light, but sellers' ideas have not weakened, asking prices remaining steady. In fact, some sellers talk about advances but that can happen only if there should be an awakening in the present dormant demand.

Manufacturers' Sales Agents for **DOMESTIC**

Sulphate of Ammonia

Ammonia Liquor :: Anhydrous Ammonia

HYDROCARBON PRODUCTS CO., INC.

500 Fifth Avenue, New York

Steamed bone meal is still in extremely light supply and firmly held. Most of this material, after being properly processed, goes into feed. The finished feed prices were recently advanced $2.50 per ton, and consequently feed materials have enjoyed a rising market.

Nominal prices are as follows: High-grade ground fertilizer tankage, $2.20 to $2.25 ($2.67½ to $2.73½ per unit N) and 10 cents; standard grades crushed feeding tankage, $2.75 to $2.80 (3.34½ to $3.40½ per unit N) and 10 cents; blood, $2.75 to $2.80 (3.34½ to 3.40½ per unit N); dry rendered tankage, 57 to 62 cents per unit of protein, Chicago basis.

WILMINGTON

Greater Activity for Fill-in Materials. Organic Market Firmer. Fish Scrap Production Smaller than Expected.

Exclusive Correspondence to "The American Fertilizer."

WILMINGTON, January 17, 1941.

There has been a little more activity in the raw material market since the turn of the year. The manufacturers are in a position to estimate more closely their spring requirements, and are filling in where necessary. The organic market generally is somewhat firmer. Offerings of blood are growing more difficult to obtain, due to the scarcity of cargo space. Cottonseed meal continues high, with activity mostly confined to direct trades to apply on fertilizer accounts or purchases. Several of the fish factories have closed down for the season and those that are still open report rather small catches. Dried scrap, when obtainable, is easily disposed of at $48.00, f.o.b. production point, with the supply short of the demand.

Superphosphate is very firm to advancing, with little surplus obtainable on this market.

The trade are looking for a slight increase in tonnage of mixed goods over last year.

PASTURE FERTILIZATION AND MANAGEMENT

(Continued from page 6)

believe that it would be best to show the picture first and perhaps attempt to answer such questions as may occur to you. I shall now show you the picture which we made in 1939 and which was revised somewhat in 1940. It will be of interest, perhaps, to state that this picture has now been shown over 1,700 times to farm audiences throughout the United States, with a total attendance of nearly 150,000 persons. Through the cooperation of the Federal Soil Conservation Service and your State Department of Vocational Education, the picture has been shown over 200 times in Pennsylvania to some 23,000 persons.

TEXAS GULF SULPHUR STARTS RESEARCH PROJECT

The Texas Gulf Sulphur Company, Inc., 75 East 45th Street, New York, N. Y., in furtherance of its policy to uncover information regarding sulphur, has inaugurated a long range program of research at Boyce Thompson Institute, Yonkers, New York. The initial investigation will be devoted to a study of the fundamentals in the use of sulphur as an insecticide and fungicide. This investigation will be under the direction of Dr. Frank Wilcoxon, a scientist well grounded in studies of this nature. It is hoped that these researches will clarify existing knowledge regarding fungicidal or insecticidal sulphur, establish specific physico-chemical data, particularly vapor pressure data of sulphur dusts and determine the influence of particle size, etc., on the efficacy of sulphur in controlling insects and plant diseases. The results of the investigation will be published from time to time so that the information may be available to all interested in this important subject.

Sulphur has been used as a fungicide and insecticide since 1848 when Duchartre in

PULVERIZED
MASCOT
LIMESTONE
Trade Mark Registered

MAGNESIUM LIMESTONE
"It's a Dolomite"
American Limestone Company
Knoxville, Tenn.

HIGRADE
MURIATE OF POTASH
62/63% K_2O
Also 50% K_2O Grade
●
MANURE SALTS
Approximately 30% K_2O
REG. U. S. PAT. OFF.

SUNSHINE STATE POTASH
A PRODUCT OF NEW MEXICO U.S.A.

GEARED FOR SMOOTH RUNNING

TO meet this country's need for adequate domestic supplies of potash, men and equipment at the United States Potash Company's mine and refinery are geared to peak efficiency. Employees and management alike recognize the new responsibility which has been placed on our nation's potash industry now that foreign supplies of this vital element have been virtually cut off.

But need for production will never cause us to neglect the quality of Sunshine State Potash. In peak as well as normal times, technical specialists, backed by complete laboratory facilities, control every step in production. Today more fertilizer producers than ever before depend upon Sunshine State Potash for consistently uniform analysis and careful sizing which makes handling and blending easy.

UNITED STATES POTASH COMPANY, INC.
30 ROCKEFELLER PLAZA
NEW YORK, N. Y.

France demonstrated that finely ground sulphur could be used in controlling diseases of grapes. Since that time sulphur in a variety of forms has been applied with success not only in the culture of grapes but also to an increasing extent in the growing of cereals, truck crops, fruits and ornamental plants or flowers. In spite of its wide use and beneficial effects, scientists are not on agreement as to its specific action or function. It is the hope of the Texas Gulf Sulphur Company that the researches undertaken will throw light on this subject and hence allow the more efficient use of sulphur in making the farmer's lot more secure and assuring to the nation ample and better supplies of foodstuff.

"MINERAL HUNGER IN LIVE STOCK"

The latest pamphlet issued by The National Fertilizer Association has to do with the effect of a deficiency of various minerals in the pasturage and feed of farm animals and poultry. The 16-page booklet, entitled "Mineral Hunger in Live Stock," discusses the symptoms which develop from a lack of such elements as calcium, phosphorus, sodium and chlorine, iodine, iron and copper, cobalt, manganese, and magnesium. Tests are quoted showing how continued grazing of pastures has depleted these elements from the soil, with resulting deterioration in the successive generations of live stock. The solution—adequate pasture fertilization—is demonstrated by many experiments carried out in various states and foreign countries. The illustrations showing typical mineral deficiency symptoms in livestock are from agricultural college, experiment station, and U. S. Department of Agriculture bulletins. The booklet is being distributed through quantity purchases by member companies of the Association.

PHOSPHORUS IN HUMAN AND ANIMAL HEALTH

(Continued from page 11)

little difficulty in satisfying the pig's requirement for phosphorus so long as his protein requirements are satisfied.

Calcium deficiencies are much more likely to occur in swine and poultry than are phosphorus deficiencies.

Sheep. Information on the phosphorus requirement of various classes of sheep is extremely scarce. It would appear from the few data available that the phosphorus requirement of growing sheep may be satisfied by a ration containing not more than 0.17 per cent phosphorus. Figures for the pregnant and lactating ewe are only a few hundredths of a per cent higher. An average figure of around 0.2 per cent would seem to represent an adequate amount of phosphorus in the ration for all classes of sheep.

Since the greater part of the sheep's ration consists of roughages which normally contain about 0.2 per cent, or possibly more, phosphorus, a deficiency of this element would not exist unless the roughages are grown on phosphorus-deficient soils. That this condition often exists in many parts of the world has already been discussed. It should, perhaps, be emphasized that affected and non-affected areas may be very close together. Quoting again from some Utah data, four samples of alfalfa from Sanpete county contained, respectively, 0.168, 0.153, 0.144, and 0.147 per cent phosphorus. However, two other samples, collected at about the same time from the same county, contained 0.331 and 0.322 per cent phosphorus. The former figures would strongly suggest the possibility of a phosphorus deficiency, while the latter certainly indicate no such deficiency.

It will be remembered that sheep are not as susceptible to aphosphorosis as are cattle. Since the danger point for cattle has been found to

NITROGANIC TANKAGE

Let us tell you about this new fertilizer material. We solicit inquiries.

H. J. BAKER & BRO.

271 Madison Ave., NEW YORK

BALTIMORE CHICAGO SAVANNAH TAMPA

FERTILIZERS AMMONIATED WITH UREA-AMMONIA LIQUORS CURE RAPIDLY

They become dry, free-flowing!

THE conditioning effect and quick curing of mixtures ammoniated with Urea-Ammonia Liquors present definite advantages over ordinary formulation.

Fertilizers ammoniated with UAL come from the mixer decidedly warm and slightly moist. On cooling, the product becomes quite dry and free-flowing, but without excessive dustiness. Curing is so rapid that, under good conditions, fertilizers ammoniated with UAL can be shipped within a few days after making.

Plans for cooler now available!

COOLING can be expedited and your fertilizer improved even further by use of a rotary fertilizer cooler, for which plans and design data are now available.

Such a cooler not only removes the heat, but in doing so it (1) reduces reversion of phosphoric acid; (2) allows use of more UAL; (3) improves condition of fertilizers; (4) reduces caking in storage; and (5) saves labor when digging down storage piles, as a result of reduction of pile set.

Write for information today.

DU PONT
REG. U.S. PAT. OFF.

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
AMMONIA DEPARTMENT WILMINGTON, DELAWARE

UAL-A UAL-B UAL-37

be around 0.12 or 0.13 per cent phosphorus, it would seem that the estimated requirement of 0.2 per cent is too high. This figure may be more generous than necessary, but since sheep begin to show signs of protein deficiency on ranges where cattle begin to show phosphorus deficiency, the danger point for both species, from a practical view at least, may be assumed to be about the same level.

Horses. Practically no information on the phosphorus requirements of various classes of horses is available. However, the requirement is certainly low and very likely is met by a ration containing 0.2 per cent phosphorus.

Cattle. Growing calves require a maximum of about 0.35 per cent phosphorus in their rations. At maturity, this percentage decreases to about 0.16 or 0.17 per cent.

To prevent the cow from drawing too heavily on her phosphorus stores during the last weeks of pregnancy and first few weeks of lactation, it is perhaps wise to include about 0.22 per cent phosphorus in her ration. Since milk contains a high percentage of phosphorus, it is to be expected that the percentage of phosphorus in her ration will increase as the milk flow increases. It may be calculated that the total phosphorus requirement of a cow producing different amounts of milk is as follows:

10 lb. of milk daily	0.20 per cent
20 lb. of milk daily	0.23 per cent
30 lb. of milk daily	0.25 per cent
40 lb. of milk daily	0.26 per cent
50 lb. of milk daily	0.27 per cent
100 lb. of milk daily	0.30 per cent

The percentage of calcium required by a lactating cow increases much more rapidly as the milk flow increases than does phosphorus.

From the above discussion, it would seem that for maximum milk production, particularly in the higher producing cows, many forages, unless supplemented with other phosphorus-rich feeds, would not furnish an adequate amount of phosphorus.

For simply growing range cattle, the percentage of phosphorus apparently need not be much greater than 0.12 or 0.13 per cent. Watkins of New Mexico states that range forage need not contain more than 0.113 per cent phosphorus to adequately nourish range livestock.

VII. Unsafe to Feed Raw Rock Phosphate to Animals

The deleterious effects of raw rock phosphate when fed to animals apparently are due to the presence of fluorine, an element that is definitely harmful in very small quantities.

Halpin and Lamb in 1932 reported that 1 per cent of rock phosphate was not harmful, that 2 per cent depressed growth and that 3 per cent was definitely toxic for growing chickens. They found no depressing effects on egg production of either of the lower levels.

In some Michigan experiments with dairy cattle, Hawaiian rock phosphate, containing the very low level of 2.51 per cent fluorine, was definitely injurious. These workers say that "ground rock phosphate as it is mined from the soil is not to be recommended as a mineral supplement."

In some Illinois experiments 5 gm. of rock phosphate daily per pig was definitely toxic.

Investigators at Wisconsin have studied the performance of growing swine on rations containing various percentages of rock phosphate. They reported normal performance on 0.4 per cent rock phosphate; that 0.8 per cent could be used for growth on pasture, but that this amount had a depressing effect on the growth rate when the pigs were fed in drylot. Reproduction was not affected by 0.8 per cent, but lactation was. A level of 1.6 per cent was definitely harmful to both growth and reproduction in drylot and on pasture. In another Wisconsin publication the general statement is made that one-fourth of the mineral supplement may consist of rock phosphate.

It seems to me that since rock phosphate owes its harmful effects to its fluorine content and since rock phosphates vary very widely in their fluorine content no general recommendations can be made. It would seem wiser not to use raw rock phosphate in any quantity for feeding livestock.

VIII. Conclusions

Phosphorus is an essential mineral element required by all classes of livestock as well as by man. Phosphorus deficiency in livestock occurs in every continent on the globe. It is most prev-

STEDMAN TYPE "S" POSITIVE MECHANICAL-TRAY VIBRATING SCREENS

Designed especially for screening complete fertilizer. Write for complete illustrated descriptive bulletin No. 502 to solve your screening problems. Six sizes. Capacities 10 to 60 tons per hour.

STEDMAN MANUFACTURES

Batch Mixers
Pan Mixers
Tailings Pulverisers
Revolving Screens
Vibrating Screens
Dust Weigh Hoppers
Acid Weigh Scales
Grinders—Swing Hammer
Cage Mills
Clod Breakers
Mixing Systems
Complete Plants

STEDMAN

STEDMAN'S FOUNDRY & MACHINE WORKS
Founded 1834
503 Indiana Ave., Aurora, Indiana, U.S.A.

WILLIAM G. WELLMANN
BROKER
Baltimore, Maryland

Specializing in

Sulphate of Ammonia
Low Grade Ammoniates
Superphosphate
Sulphuric Acid
Bags

Inquiries and offerings invited

KEYSER BUILDING

DEPENDABLE!

- Large stocks of seasoned materials, available for prompt shipment keyed to your needs.
- Dependable analysis—and every shipment reaches you in good mechanical condition. Write or wire us your next order for

TRIPLE SUPERPHOSPHATE

46 to 48% Available Phosphoric Acid

●

We also manufacture
HIGH-GRADE SUPERPHOSPHATE

●

U. S. Phosphoric Products
Division
TENNESSEE CORPORATION
Tampa, Florida

New York Offices:
61 Broadway
New York, N. Y.

Sales Agents:
Bradley & Baker
155 East 44th St.
New York, N. Y.

A Mark of FLORIDA TRIPLE PHOSPHATE *Reliability*

SPECIFY
THREE ELEPHANT
BORAX

REG. U.S. PAT. OFF. REG. U.S. PAT. OFF.

. . . . WHEN BORON IS NEEDED TO CORRECT A DEFICIENCY OF THIS IMPORTANT SECONDARY ELEMENT

Agricultural authorities have shown that a lack of Boron in the soil can result in deficiency diseases which seriously impair the yield and quality of crops.

When Boron deficiencies are found, follow the recommendations of local County Agents or State Experiment Stations.

Information and references available on request.

AMERICAN POTASH & CHEMICAL CORPORATION
70 PINE STREET, NEW YORK CITY
Pioneer Producers of Muriate of Potash in America
See Page 4

alent in range animals and is caused by an insufficient amount of available phosphorus in the soil, this in turn producing crops with subnormal amounts of phosphorus. When animals subsist for long periods of time on ranges which furnish less than 0.12 or 0.13 per cent phosphorus on the dry basis, phosphorus deficiency is likely to occur. The disease is referred to as aphosphorosis, and cattle in particular are most susceptible. Sheep and horses are somewhat less susceptible than cattle.

The livestock industry throughout the world has suffered an inestimable loss due to aphosphorosis. Weathering, leaching, cropping, and the practise of feeding in corrals without redistribution of the manure are continually removing phosphorous from the soils, thus slowly and surely producing more and more phosphorus-deficient areas.

The continued success of a livestock industry depends upon the maintenance of healthy and productive animals. Any type of malnutrition, such as aphosphorosis, is definitely linked with soil fertility. The prevention of aphosphorosis, as well as the prevention of many other nutritional maladies, depends upon a sound, well-ordered plan for conserving and maintaining an adequate soil fertility. Without the adoption of such a plan, aphosphorosis will continue to take its toll in decreased meat, milk, and offspring.

NO SKYROCKETING OF FERTILIZER PRICES

(Continued from page 8)

however, scarcity of ship bottoms to move the rock from Florida and of railroad cars to move it from Tennessee. Sulphuric acid, of which each ton of superphosphate contains about 900 lbs., was also in considerably more limited supply than it is now.

Superphosphate Plentiful

There is still another favorable factor, having to do with the perfection of the flotation process for the removal of impurities in the phosphate rock. A ship carrying rock from Florida can deliver now more tons of phosphorus to northern ports than the same ship could do in the first World War when carrying the same tonnage. The flotation process now removes much more of the silica and other inert material. America possesses around three-quarters of all the known phosphorus in the world. Florida alone has enough phosphate rock to last this country, at the present rate of consumption, approximately 2,000 years. It is unlikely that the enormous deposits in and near the American and Canadian Rockies will ever be seriously worked in our time. Superphosphate is certain to remain relatively cheap in this country.

The price of superphosphate next spring may be a half dollar to one dollar per ton higher for 20 per cent than it was a year earlier to compensate for increased labor and bag costs.

CHEMISTS' YEAR BOOK

The year book of the Manufacturing Chemists' Association, Chemical Facts and Figures, 1940," has recently been issued by that organization. It contains factual information in the form of graphs and statistics on the American Chemical Industry. In most cases, data have been tabulated for a period of ten years. Containing 220 pages, the book is priced at 65 cents postpaid (75 cents west of the Mississippi River) and can be obtained from the offices of the Manufacturing Chemists' Association, 608 Woodward Building, Washington, D. C.

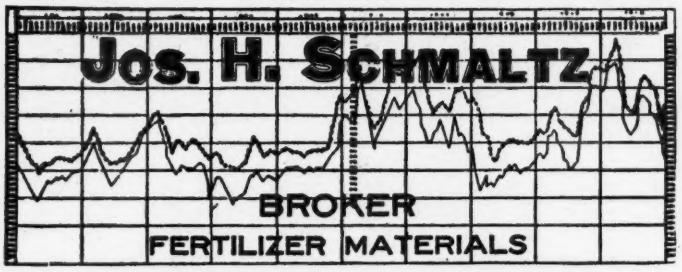
AMERICAN CYANAMID INSTALLS ELECTRON MICROSCOPE

(Continued from page 7)

pilot plant units turn out quantities varying from a few pounds to a few tons of new products for plant scale tests before manufacture of a full scale is undertaken.

The equipment of the Stamford Laboratories, to which the electron microscope has now been added, is complete and modern and ranks it as one of the leaders among the nearly 1,800 research laboratories now operated in the United States for the benefit of industry. The personnel of the laboratory includes 230 scientists assisted by a staff of nearly 200 other workers. In addition to the Stamford Laboratories, American Cyanamid Company maintains research laboratories for studying special problems at its Calco Chemical Division, Bound Brook, N. J., and at the plants of its subsidi-

Tankage
Blood
Bone
All
Ammoniates



327
South
La Salle
Street
CHICAGO

OFFICIAL BROKER FOR MILORGANITE

If You Can See

A GLANCE AT THE **Adams' Formula Rule**

will show how many pounds of raw material are necessary to obtain a fertilizer mixture of any desired formula. No figuring, no guess work, no inaccuracies. Now revised for use with materials of highest analysis.

The Adams' Rule fits the pocket. Price, $1.00. Please remit with order

WARE BROS. COMPANY :: :: :: 1330 Vine St., Philadelphia

Ashcraft-Wilkinson Co.

Fertilizer Materials ▲▼ *Cottonseed Products*

DIRECT IMPORTATIONS OF

Nitrogenous Material - Bone Meal
Nitrate of Soda - Potash Salts
Sulphate of Ammonia

South American Blood and Tankage
Foreign Whale and Fish Guano

Exclusive Selling Agents
DUVAL TEXAS SULPHUR COMPANY, HOUSTON, TEXAS

Home Office: **ATLANTA, GA.** CABLE ADDRESS: ASHCRAFT

Offices: NORFOLK, VA., National Bank of Commerce Bldg.; CHARLESTON, S. C., Exchange Bank Bldg.

aries, Lederle Laboratories, Pearl River, N. Y., and Davis & Geck, Inc., Brooklyn, N. Y.

The electron microscope is based on the fact that fast-moving electrons possess a wave length far shorter than that of visible light. In the best optical instruments, the wave length of visible light places a lower limit on the size of the smallest detail in an object that can be seen, however great the magnification may be. Practically, this limit is reached when the object is magnified one to two thousand times. If ultraviolet light of shorter wave length is used in a microscope provided with Quartz lenses, still smaller objects can be photographed and studied. The limit of magnification of an instrument of this type is about twice that of a microscope using visible light. In the electron microscope, the radiation involved is an actual stream of infinitesimally minute electrically charged entities, called electrons, whose associated wave length is of the order of a hundred thousand times smaller than the wave length of even ultraviolet light. As a result of this minute wave length, the limit of the useful magnification of the present electron microscope—and this may be substantially increased by future development—is approximately one of two hundred thousand times actua! size. Thus, objects whose dimensions are one-one hundredth to one-fiftieth those of the smallest object to be seen with visible light can be pictured with electrons in equal detail.

Magnetic

The electron microscope resembles in principle a radio tube in which a hot filament serves as a source of a stream of electrons. Unlike a radio tube, however, the stream of electrons in the microscope is focussed and directed through a vacuum tube about four feet long by magnetic "lenses." These "lenses" are actual electromagnets which cause the stream of electrons to focus or change direction in much the same way the glass or quartz lenses focus light. The stream of electrons thus produces extraordinary magnification of the image of an object through which it has passed. The electron stream originating from the electrically-heated tungsten wire filament is given high velocity by an electrical field of 50 to 60 thousand volts produced in that part of the instrument. The swift stream of electrons is then passed through a magnetic field to focus it on the object being examined. As the electron stream passes through the thin section of the specimen, variations in its thickness or density scatter or absorb parts of the beam. When the beam is finally focussed on the viewing screen or photographic plate, an image of the object is formed. The entire instrument is continuously pumped to a high vacuum to prevent scattering of the electrons by collisions with molecules of air or other gas that might otherwise be in their way.

The image of the object examined is obtained by placing a fluorescent screen, similar to that used with x-rays and in television receivers, in the path of the electrons. The screen glows in proportion to the density of the electron stream striking it and thus reveals the magnified image. A photographic plate can be substituted for the fluorescent screen to take a picture of the object. Ordinarily the magnification of the contact print from the photographic plate is about 10 to 30 thousand times natural size. However, the details of the object are so clearly delineated that the photograph can easily be enlarged many times to give a final magnification of one to two hundred thousand times.

The smallest distance that has so far been clearly revealed by the electron microscope is about 30 Angstrom units (about one ten-millionth of an inch.) This is shorter than the dimensions of the molecules of synthetic resins as deduced from indirect measurements. Thus the size of large molecules may be actually measurable by means of the new instrument.

The electron microscope consists of a straight metal tube about four feet long, provided with electron source, three magnetic "lenses," a special air lock for introducing the specimen and a second air lock for placing the photographic plate in position. Essential to its operation is a source of electric current of exactly controlled voltage. The voltage-regulating equipment consists of fifty-two vacuum tubes (enough for five modern transatlantic radio receivers) with accompanying apparatus for converting ordinary commercial electric current to one of 50,000 volts constant within a single volt.

SACKETT EQUIPMENT
for the Fertilizer Plant
BATCH MIXERS • PULVERIZERS
SCREENS • BUCKET ELEVATORS
CONTINUOUS AMMONIATING EQUIPMENT
BASING, MIXING & BAGGING UNITS
COMPLETE FERTILIZER PLANTS
THE A.J. SACKETT & SONS CO.
1701 S. HIGHLAND AVE., BALTIMORE, MD.

Books on Agriculture and Fertilizers

Commercial Fertilizers

By GILBERT H. COLLINGS, PH.D., Associate Professor of Agronomy, Clemson Agricultural College. A modern, complete study of all fertilizer problems, well illustrated. The book gives actual research data, and the work of many agronomists, chemists and engineers has been reviewed. Each chapter has been read by authorities connected with organizations producing or marketing the products discussed; thus it represents a composite of the best opinions and conclusions in the fertilizer industry. 365 pages. 85 illustrations. Price $4.00.

Handbook of Fertilizers

By A. F. GUSTAFSON, PH.D., Professor of Soil Technology, Cornell University. A revised edition of this popular treatise. Covers the sources, character and composition of fertilizers and fertilizer materials. The food requirements of different crops and the effects of different fertilizers. A valuable volume for fertilizer manufacturers and salesmen, county agents, agricultural teachers, farmers and truckers. 172 pages. 5 x 8. Price $1.75.

Manures and Fertilizers

By H. J. WHEELER. A clear and unusually full discussion of the practical utilization of manures and fertilizers of all kinds and of their relations to the plant and to the soil. 389 pages. 5½ x 7½. Illustrated. Price $2.75.

Phosphoric Acid, Phosphates and Phosphatic Fertilizers

By W. H. WAGGAMAN. A comprehensive treatise, covering completely the subjects of phosphoric acid and phosphate—the sources, the processes of treatment, the products obtained, and their uses in agriculture and the arts. The volatilization process for producing phosphoric acid is fully discussed. In addition to the use of phosphate as a fertilizer material, there are chapters on phosphate baking powders, phosphate water softeners, and miscellaneous uses. This book is one of the American Chemical Society's technologic monographs and contains extended references to the literature, which facilitates further study of the subject. 366 pages. Price $5.75.

Potash Deficiency Symptoms

By OSKAR ECKSTEIN, ALBERT BRUNO AND J. W. TURRENTINE. A revised edition which explains in detail the signs of potash deficiency in all the important cultivated crops as shown in appearance and structure of leaf, root, fruit, etc.; also the influence of a lack of potash on resistance to plant diseases, pests and climatic factors. Printed in English, French and German. Profusely illustrated with 55 color plates and 41 black and white engravings. 248 pages. 7 x 9½. Price $2.25.

Potash: A Review, Estimate and Forecast

By J. W. TURRENTINE, M.S., PH.D., in charge of Potash Investigations, Bureau of Soils, U. S. Department of Agriculture. This book, written by an authority on the subject, covers in detail the American and foreign potash industry. This book deals with the technology of potash manufacture from numerous raw materials; the occurrence, properties and relative values of various potash minerals and the technology of extraction; the technology of utilizing potash-bearing industrial wastes for the manufacture of potash salts. European and other foreign sources of supply are given special attention. 188 pages. 6 x 9. Illustrations and tables. Price $3.00.

Soil Management

By FIRMAN E. BEAR, PH.D. This is a revised and enlarged edition of a book which was an accepted text book in schools with agricultural courses, and which also enjoyed a wide general circulation. The author has made a study of soils for many years, both in this country and in Europe. The 26 chapters cover five divisions of the subject—requirements of soils, characteristics of soils, utilizing soil resources and supplementing soil resources. The last division treats most effectively of fertilizers. 412 pages. 6 x 9. 58 figures. Price $3.50.

Sulphuric Acid Manufacture

By ANDREW M. FAIRLIE. This volume covers thoroughly the production of sulphuric acid from its earliest beginnings to the latest developments in both chamber and contact systems. Modern apparatus, plant construction and production methods are described in detail, with numerous illustrations. Other chapters are also included on the production of raw materials as well as the uses, handling methods, cost accounting methods, etc., of the finished product. An American Chemical Society Monograph. 632 pages. 6 x 9. Price $9.75.

Theory and Practice in the Use of Fertilizers

By FIRMAN E. BEAR, PH.D. Second revised edition, covering the progress in the manufacture and use of fertilizers during recent years. The history of the science of fertilizers from the time of Jethro Tull to the present era. Fertilizer practice, both in Europe and America, is completely examined. The various schemes that have been proposed for determining what fertilizers to use are thoroughly treated. A comparison of fertilizers and their relative values is made. Also, there are concise statements of determining the fertilizer needs, and specific suggestions as to the use of fertilizers. 360 pages. 6 x 9. Price $4.00.

Any of the above sent postpaid on receipt of price. A full list of books on these subjects sent free on request.

WARE BROS. COMPANY

1330 Vine Street - - - - Philadelphia, Pa.

BUYERS' GUIDE

A CLASSIFIED INDEX TO ALL THE ADVERTISERS IN "THE AMERICAN FERTILIZER"

This list contains representative concerns in the Commercial Fertilizer Industry, Including fertilizer manufacturers, machinery and equipment manufacturers, dealers in and manufacturers of commercial fertilizer materials and supplies, brokers, chemists, etc.
For Alphabetical List of Advertisers, see page 33.

ACID BRICK
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

ACID EGGS
Chemical Construction Corp., New York City.

ACIDULATING UNITS
Chemical Construction Corp., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

AMMO-PHOS
American Cyanamid Co., New York City.

AMMONIA—Anhydrous
Barrett Company, The, New York City.
Du Pont de Nemours & Co., E. I., Wilmington, Del.
Hydrocarbon Products Co., New York City.

AMMONIA LIQUOR
Barrett Company, The, New York City.
Du Pont de Nemours & Co., E. I., Wilmington, Del.
Hydrocarbon Products Co., New York City.

AMMONIA OXIDATION UNITS
Chemical Construction Corp., New York City.

AMMONIATING EQUIPMENT
Sackett & Sons Co., The A. J., Baltimore, Md.

AUTOMATIC ELEVATOR TAKEUPS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

BABBITT
Sackett & Sons Co., The A. J., Baltimore, Md.

BAGS AND BAGGING—Manufacturers
Bagpak, Inc., New York City.
Bemis Bro. Bag Co., St. Louis, Mo.
Fulton Bag & Cotton Mills, Atlanta, Ga.

BAGS—Cotton
Bemis Bro. Bag Co., St. Louis, Mo.
Fulton Bag & Cotton Mills, Atlanta, Ga.

BAGS—Paper
Bagpak, Inc., New York City.
Bemis Bro. Bag Co., St. Louis, Mo.

BAGS (Waterproof)—Manufacturers
Bemis Bro. Bag Co., St. Louis, Mo.
Fulton Bag & Cotton Mills, Atlanta, Ga.

BAGS—Dealers and Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

BAGGING MACHINES—For Filling Sacks
Atlanta Utility Works, East Point, Ga.
Bagpak, Inc., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

BAG-CLOSING MACHINES
Bagpak, Inc., New York City.

BAG PILERS
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.

BEARINGS
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

BELT LACING
Sackett & Sons Co., The A. J., Baltimore, Md.

BELTING—Chain
Atlanta Utility Works, East Point, Ga.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

BELTING—Leather, Rubber, Canvas
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Sackett & Sons Co., The A. J., Baltimore, Md.

BOILERS—Steam
Atlanta Utility Works, East Point, Ga.

BONE BLACK
American Agricultural Chemical Co., New York City.
Armour Fertilizer Work, Atlanta, Ga.
Huber & Company, New York City.

BONE PRODUCTS
American Agricultural Chemical Co., New York City.
Armour Fertilizer Work, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

BORAX AND BORIC ACID
American Potash and Chem. Corp., New York City.
Pacific Coast Borax Co., New York City.

BROKERS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Keim, Samuel L., Philadelphia, Pa.
Schmaltz, Jos. H., Chicago, Ill.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

BUCKETS—Elevator
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

HENRY L. TAYLOR, *Broker*
Bentley's Code Cable Address "HLTAYLOR"
NORTH CAROLINA BANK BLDG., WILMINGTON, N. C.

Menhaden Fish Products
and
Fertilizer Materials

A Classified Index to Advertisers in "The American Fertilizer"

BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 33

BUCKETS—For Hoists, Cranes, etc., Clam Shell, Orange Peel, Drag line, Special; Electrically Operated and Multi Power
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.

BURNERS—Sulphur
Chemical Construction Corp., New York City.

BURNERS—Oil
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.

CABLEWAYS
Hayward Company, The, New York City.

CALCIUM-NITRATE
Synthetic Nitrogen Products Co., New York City.

CAL-NITRO
Synthetic Nitrogen Products Co., New York City.

CARBONATE OF AMMONIA
American Agricultural Chemical Co., New York City.
Du Pont de Nemours & Co., E. I., Wilmington, Del.

CARS—For Moving Materials
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CARTS—Fertilizer, Standard and Roller Bearing
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

CASTINGS—Acid Resisting
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

CASTINGS—Iron and Steel
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CEMENT—Acid-Proof
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

CHAIN DRIVES—Silent
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAINS AND SPROCKETS
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAMBERS—Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

CHEMICAL APPARATUS
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

CHEMICALS
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Company, The, New York City.

CHEMICALS—Continued
Bradley & Baker, New York City.
Du Pont de Nemours & Co., E. I., Wilmington, Del.
Huber & Company, New York City.
Wellmann, William E., Baltimore, Md.

CHEMICAL PLANT CONSTRUCTION
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHEMISTS AND ASSAYERS
Gascoyne & Co., Baltimore, Md.
Shuey & Company, Inc., Savannah, Ga.
Stillwell & Gladding, New York City.
Wiley & Company, Baltimore, Md.

CLUTCHES
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CONCENTRATORS—Sulphuric Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

CONDITIONERS AND FILLERS
American Limestone Co., Knoxville, Tenn.
Phosphate Mining Co., The, New York City

CONTACT ACID PLANTS
Chemical Construction Corp., New York City.

COTTONSEED PRODUCTS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

CRANES AND DERRICKS
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Link-Belt Speeder Corp., Chicago, Ill. and Cedar Rapids, Iowa.
Sackett & Sons Co., The A. J., Baltimore, Md.

CYANAMID
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Jett, Joseph C., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

DENS—Superphosphate
Chemical Construction Corp., New York City.
Stedman's Foundry and Mach. Works, Aurora, Ind.

Andrew M. Fairlie
CHEMICAL ENGINEER
22 Marietta Street Building ATLANTA, GA.
CABLE ADDRESS: "SULFACID ATLANTA"

SULPHURIC Acid Plants . . . Design, Construction, Equipment . . . Operation . . . Mills-Packard Water-Cooled Acid Chambers, Gaillard Acid-Cooled Chambers, Gaillard Acid Dispersers, Contact Process Sulphuric Acid Plants.

A Classified Index to Advertisers in "The American Fertilizer"

BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 33

DISINTEGRATORS
Atlanta Utility Works, East Point, Ga.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

DRYERS—Direct Heat
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Sackett & Sons Co., The A. J., Baltimore, Md.

DRIVES—Electric
Link-Belt Company, Philadelphia, Chicago.

DUMP CARS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

DUST COLLECTING SYSTEMS
Sackett & Sons Co., The A. J., Baltimore, Md.

ELECTRIC MOTORS AND APPLIANCES
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

ELEVATORS
Atlanta Utility Works, East Point, Ga.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

ELEVATORS AND CONVEYORS—Portable
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

ENGINEERS—Chemical and Industrial
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

ENGINES—Steam
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

EXCAVATORS AND DREDGES—Drag Line and Cableway
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Link-Belt Speeder Corp., Chicago, Ill. and Cedar Rapids, Iowa.

FERTILIZER MANUFACTURERS
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Farmers Fertilizer Co., Columbus, Ohio.
International Agricultural Corp., New York City.
Smith-Rowland Co., Norfolk, Va.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.

FISH SCRAP AND OIL
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

FOUNDERS AND MACHINISTS
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

GARBAGE TANKAGE
Wellmann, William E., Baltimore, Md.

GEARS—Machine Moulded and Cut
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

GEARS—Silent
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

GELATINE AND GLUE
American Agricultural Chemical Co., New York City.

GUANO
Baker & Bro., H. J., New York City.

HOISTS—Electric, Floor and Cage Operated, Portable
Hayward Company, The, New York City.
Jeffrey Manufacturing Co., The, Columbus, Ohio.

HOPPERS
Atlanta Utility Works, East Point, Ga.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

IMPORTERS, EXPORTERS
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Wellmann, William E., Baltimore, Md.

IRON SULPHATE
Tennessee Corporation, Atlanta, Ga.

INSECTICIDES
American Agricultural Chemical Co., New York City.

LACING—Belt
Sackett & Sons Co., The A. J., Baltimore, Md.

LIMESTONE
American Agricultural Chemical Co., New York City.
American Limestone Co., Knoxville, Tenn.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Wellmann, William E., Baltimore, Md.

LOADERS—Car and Wagon, for Fertilizers
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Acid Making
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Coal and Ash Handling
Hayward Company, The, New York City.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Elevating and Conveying
Atlanta Utility Works, East Point, Ga.
Hayward Company, The, New York City.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

A Classified Index to Advertisers in "The American Fertilizer"

BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 33

MACHINERY—Grinding and Pulverizing
Atlanta Utility Works, East Point, Ga.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Power Transmission
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Pumping
Atlanta Utility Works, East Point, Ga.

MACHINERY—Tankage and Fish Scrap
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MAGNESIA
California Chemical Co., New York City.

MAGNETS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MANGANESE SULPHATE AND CARBONATE
Tennessee Corporation, Atlanta, Ga.

MANGANESE SULPHATE
Tennessee Corportion, Atlanta, Ga.

MIXERS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

NITRATE OF SODA
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Company, The, New York City.
Bradley & Baker, New York City.
Chilean Nitrate Sales Corp., New York City.
Huber & Company, New York City.
International Agricultural Corp., New York City.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

NITRATE OVENS AND APPARATUS
Chemical Construction Corp., New York City.

NITROGENOUS ORGANIC MATERIAL
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Du Pont de Nemours & Co., E. I., Wilmington, Del.
Huber & Company, New York City.
International Agricultural Corp., New York City.
Smith-Rowland Co., Norfolk, Va.
Wellmann, William E., Baltimore, Md.

NOZZLES—Spray
Monarch Mfg. Works, Inc., Philadelphia, Pa.

PACKING—For Acid Towers
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

PANS AND POTS
Stedman's Foundry and Mach. Works, Aurora, Ind.

PHOSPHATE MINING PLANTS
Chemical Construction Corp., New York City.

PHOSPHATE ROCK
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Charleston Mining Co., Inc., Richmond, Va.
Huber & Company, New York City.
International Agricultural Corp., New York City.
Jett, Joseph C., Norfolk, Va.
Phosphate Mining Co., The, New York City
Ruhm, H. D., Mount Pleasant, Tenn.
Schmaltz, Jos. H., Chicago, Ill.
Southern Phosphate Corp., Baltimore, Md.
Taylor, Henry L., Wilmington, Del.
Wellmann, William E., Baltimore, Md.

PIPES—Chemical Stoneware
Chemical Construction Corp., New York City.

PIPES—Wooden
Stedman's Foundry and Mach. Works, Aurora, Ind.

PLANT CONSTRUCTION—Fertilizer and Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

POTASH SALTS—Dealers and Brokers
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Agricultural Corp., New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Synthetic Nitrogen Products Co., New York City.
Taylor, Henry L., Wilmington, Del.
Wellmann, William E., Baltimore, Md.

POTASH SALTS—Manufacturers and Importers
American Potash and Chem. Corp., New York City.
Potash Co. of America, Baltimore, Md.
United States Potash Co., New York City.

PULLEYS AND HANGERS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

PUMPS—Acid-Resisting
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

PYRITES—Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Jett, Joseph C., Norfolk, Va.
Wellmann, William E., Baltimore, Md.

QUARTZ
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

RINGS—Sulphuric Acid Tower
Chemical Construction Corp., New York City.

A Classified Index to Advertisers in "The American Fertilizer"

BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 33

ROUGH AMMONIATES
Bradley & Baker, New York City.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

SCALES—Including Automatic Bagging
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SCRAPERS—Drag
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.

SCREENS
Atlanta Utility Works, East Point, Ga.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SEPARATORS—Air
Sackett & Sons Co., The A. J., Baltimore, Md.

SEPARATORS—Including Vibrating
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

SEPARATORS—Magnetic
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SHAFTING
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SHOVELS—Power
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Link-Belt Speeder Corp., Chicago, Ill. and Cedar Rapids, Iowa.
Sackett & Sons Co., The A. J., Baltimore, Md.

SPRAYS—Acid Chambers
Monarch Mfg. Works, Inc., Philadelphia, Pa.

SPROCKET WHEELS (See Chains and Sprockets)

STACKS
Sackett & Sons Co., The A. J., Baltimore, Md.

SULPHATE OF AMMONIA
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Company, The, New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Hydrocarbon Products Co., New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

SULPHUR
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Freeport Sulphur Co., New York City.
Texas Gulf Sulphur Co., New York City.

SULPHURIC ACID
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.

SULPHURIC ACID—Continued
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Wellmann, William E., Baltimore, Md.

SUPERPHOSPHATE
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Agricultural Corp., New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Taylor, Henry L., Wilmington, N. C.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Wellmann, William E., Baltimore, Md.

SUPERPHOSPHATE—Concentrated
Armour Fertilizer Works, Atlanta, Ga.
International Agricultural Corp., New York City.
Phosphate Mining Co., The, New York City
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.

SYPHONS—For Acid
Monarch Mfg. Works, Inc., Philadelphia, Pa.

TALLOW AND GREASE
American Agricultural Chemical Co., New York City

TANKAGE
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
International Agricultural Corp., New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Smith-Rowland Co., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

TANKAGE—Garbage
Huber & Company, New York City.

TANKS
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Sackett & Sons Co., The A. J., Baltimore, Md.

TILE—Acid-Proof
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

TOWERS—Acid and Absorption
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

UNLOADERS—Car and Boat
Hayward Company, The, New York City.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

UREA
Du Pont de Nemours & Co., E. I., Wilmington, Del.

UREA-AMMONIA LIQUOR
Du Pont de Nemours & Co., E. I., Wilmington, Del.

VALVES—Acid-Resisting
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Jeffrey Manufacturing Co., The, Columbus, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

WHEELBARROWS (See Carts)

ALPHABETICAL LIST OF ADVERTISERS

For Classified Index, see pages 28 to 32, inclusive

American Agricultural Chemical Co., New York City 3
American Cyanamid Co., New York City..34
American Limestone Co., Knoxville, Tenn..18
American Potash and Chemical Corp., New York City 4, 23
Armour Fertilizer Works, Atlanta, Ga.....16
Ashcraft-Wilkinson Co., Atlanta, Ga.....25
Atlanta Utility Works, East Point, Ga.....34

Bagpak, Inc., New York City .....—
Baker & Bro., H. J., New York City, Front cover, 20
Barrett Company, The, New York City, Back cover
Bemis Bro. Bag Company, St. Louis, Mo...24
Bradley & Baker, New York City.....14

Charleston Mining Co., Inc., Richmond, Va.—
Charlotte Chemical Lab., Charlotte, N. C...—
Chemical Construction Corp., New York City .....—
Chilean Nitrate Sales Corp., New York City.—

Dougherty, Jr., E., Philadelphia, Pa.....33
DuPont de Nemours & Co., E. I., Wilmington, Del. 21
Duriron Company, Dayton, Ohio.....—

Fairlie, Andrew M., Atlanta, Ga.....29
Farmers Fertilizer Co., Columbus, Ohio...34

Gascoyne & Co., Inc., Baltimore, Md.....34

Hayward Company, The, New York City..34
Huber Company, L. W., New York City..—
Hydrocarbon Products Co., New York City.17

International Agricultural Corporation, New York City .....2d cover

Jeffrey Manufacturing Co., The, Columbus, Ohio .....—
Jett, Joseph C., Norfolk, Va. 34

Keim, Samuel D., Philadelphia, Pa. 33

Link-Belt Company, Chicago, Ill. .....—

Monarch Mfg. Works, Inc., Philadelphia, Pa. 34

Pacific Coast Borax Co., New York City, 2d cover
Phosphate Mining Co., The, New York City 4
Polk Co., R. L., Detroit, Mich. .....—
Potash Co. of America, Baltimore, Md., 3d cover

Ruhm, H. D., Columbia, Tenn. 34

Sackett & Sons Co., The A. J., Baltimore, Md. 26
Schmaltz, Jos. H., Chicago, Ill. 25
Shuey & Company, Inc., Savannah, Ga. 34
Smith-Rowland Co., Norfolk, Va.....—
Southern Phosphate Corp., Baltimore, Md. —
Stedman's Foundry and Machine Works, Aurora, Ind. 22
Stillwell & Gladding, New York City.....34
Synthetic Nitrogen Products Co., New York City .....—

Taylor, Henry L., Wilmington, N. C.....28
Tennessee Corporation, Atlanta, Ga. .....—
Texas Gulf Sulphur Co., New York City..—

U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.....23
United States Potash Co., New York City..19

Wellmann, William E., Baltimore, Md.....23
Wiley & Company, Inc., Baltimore, Md. 34

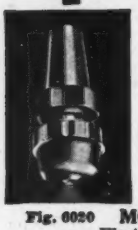
SAMUEL D. KEIM

By-Products *and* Fertilizer Materials

(SINCE 1898)

1612 MARKET STREET
PHILADELPHIA, PENNA.

E. DOUGHERTY, JR., Manager



MONARCH
Chamber Sprays

Have replaced other sprays in most plants throughout the world. Made of stoneware. Will not break or crack from temperature changes. Hard lead body and cap.

For Scrubbing Acid Gases

Where acids affect our cast brass or "Everdur" nozzles, Fig. 645, we suggest **Hard Rubber Nozzles.**

See Catalog 6-C

Fig. 6020 **MONARCH MFG. WORKS, INC.**
Westmoreland and Emery Sts., Phila., Pa.

Hayward Buckets

Use this Hayward Class "K" Clam Shell for severe superphosphate digging and handling.
THE HAYWARD CO., 202 Fulton St., New York

GASCOYNE & CO., INC.
Established 1887
Chemists and Assayers
Public Weighers and Samplers
27 South Gay Street - BALTIMORE, MD.

Stillwell & Gladding
Established 1868
WE MAKE ANALYSES OF ALL KINDS
130 Cedar Street :: NEW YORK

The Farmers Fertilizer Co.
Manufacturers
COMPLETE FERTILIZERS
BULK SUPERPHOSPHATE
SULPHURIC ACID
Acid plant capacity, 45,000 tons. Fertilizer plant capacity, 50,000 tons
Get in touch with us. COLUMBUS, OHIO

SHUEY & COMPANY, Inc.
Specialty: Analysis of Fertilizer Materials and Phosphate Rock. Official Chemists for both Florida Hard Rock Phosphate and Pebble Phosphate Export Associations. Official Weigher and Sampler for the National Cottonseed Products Association at Savannah; also Official Chemists for National Cottonseed Products Association.
115 E. BAY STREET, SAVANNAH, GA.

FOR SALE
UP TO 5,000 ACRES OF TENNESSEE
PHOSPHATE LANDS
Mineral Rights or Fee Simple
BEST AND SAFEST PLACE TO INVEST IDLE MONEY
H. D. RUHM COLUMBIA, TENN.

JETT
BROKER

ALL FERTILIZER MATERIALS

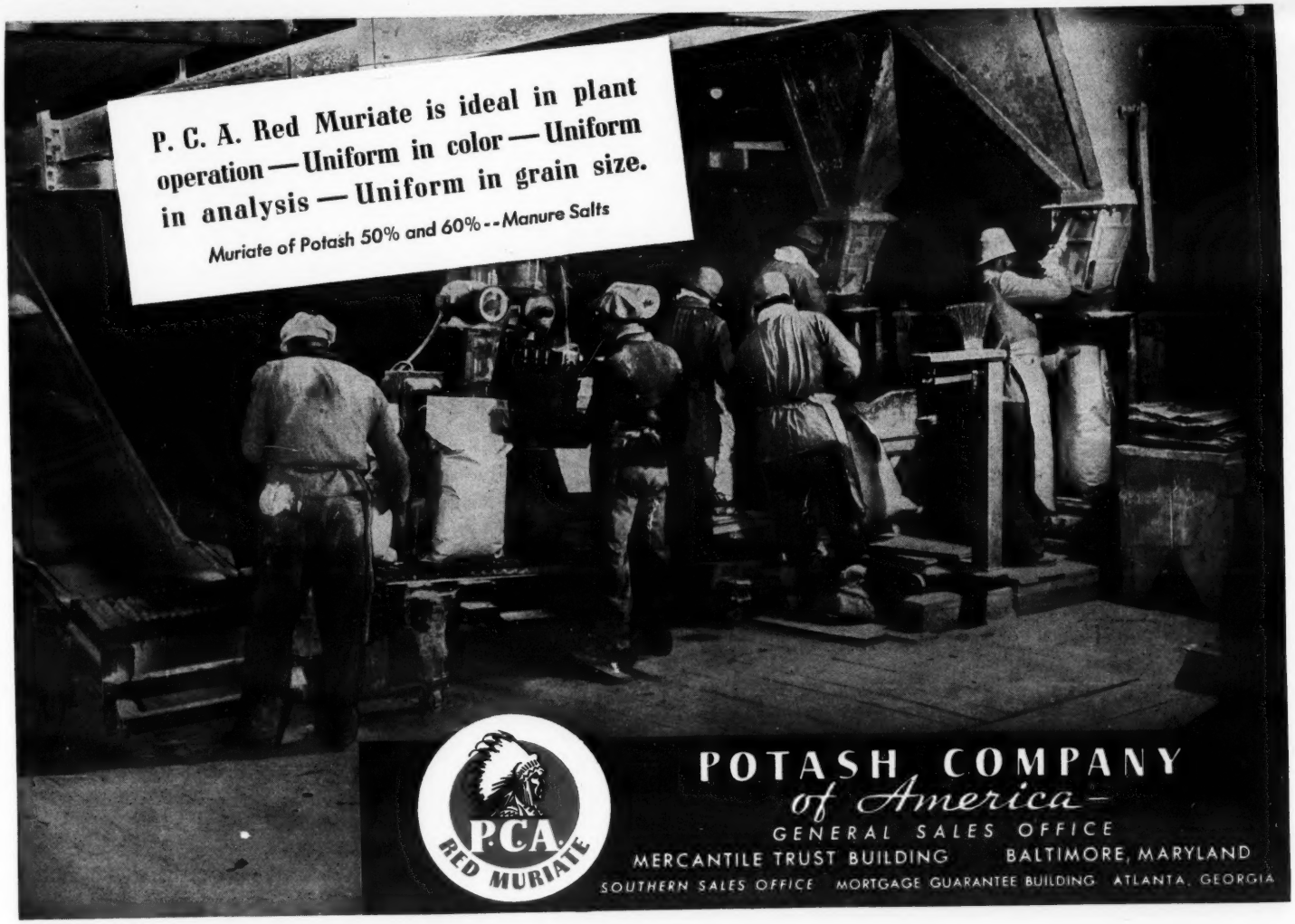
FISH SCRAP for Fertilizer and Fish Meal for Feed, Nitrate of Soda, Sulphate of Ammonia, Potash Salts, Superphosphate (Acid Phosphate), Meals, South American and Domestic Tankage and Blood, Foreign Fish Guano.

JOS. C. JETT
Board of Trade Building
NORFOLK, VA.

WILEY & COMPANY, Inc.
Analytical and Consulting Chemists
BALTIMORE, MD.

Steer Clear of Conditioning Troubles
Neutralize Free Acid with
'Aero' Cyanamid

Fertilizer Machinery *AND* Acidulating Equipment
BATCH MIXERS — PULVERIZERS — CAGE MILLS — SCREENS — SCALES
ELEVATORS, AND ALL OTHER EQUIPMENT FOR COMPLETE PLANTS
ATLANTA UTILITY WORKS - - EAST POINT, GA.


P. C. A. Red Muriate is ideal in plant operation — Uniform in color — Uniform in analysis — Uniform in grain size.
Muriate of Potash 50% and 60% -- Manure Salts
P.C.A.
RED MURIATE
POTASH COMPANY
of America
GENERAL SALES OFFICE
MERCANTILE TRUST BUILDING BALTIMORE, MARYLAND
SOUTHERN SALES OFFICE MORTGAGE GUARANTEE BUILDING ATLANTA, GEORGIA

MENTION "THE AMERICAN FERTILIZER" WHEN WRITING TO ADVERTISERS.

DUST is not a MUST any more —

DUST is waste. Dust cuts efficiency. Dust is a nuisance to the producer and to the user of fertilizer . . . But, you can minimize dust in your plant and in your product . . . ***Barrett*** NITROGEN SOLUTIONS enable you to formulate rapid-curing, non-dusty, non-segregating, granular, easy-to-manufacture mixtures. And, exclusive with ***Barrett*** NITROGEN SOLUTIONS is the fact that they supply both Nitrate and Ammonia Nitrogen *at no extra cost.*

The services of our technical men are available to you on request.

THE BARRETT COMPANY, NEW YORK, N.Y.

HOPEWELL, VA. COLUMBIA, S. C. MONTGOMERY, ALA. MEMPHIS, TENN.
RALEIGH, N. C. ATLANTA, GA. NEW ORLEANS, LA. SAN FRANCISCO, CAL.

Headquarters for American-made Nitrogen

Barrett NITROGEN